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ABSTRACT

Noting the limitations of recent word recognition research, this paper suggests ways that these limitations might be overcome and then extends these suggestions into a framework for distinguishing between good and poor readers' ability to comprehend words. The paper begins by reviewing the major models of word recognition and discussing their limitations. It then proposes a new model that considers the social context of the reading act, its motivational context, the schema brought to the task by the reader, and the reader's range of strategies for operating within the framework of the linguistic context of a word, phrase, sentence, paragraph, or story. It concludes be defining good and poor readers in light of the new model. (FL)

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THE INTERACTION BETWEEN LINGUISTIC AND PARALINGUISTIC FACTORS IN WORD RECOGNITION: TOWARDS A PRELIMINARY MODEL AND ITS IMPLICATIONS FOR DEFINING GOOD AND POOR READERS

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THE INTERACTION BETWEEN LINGUISTIC AND PARALINGUISTIC FACTORS IN WORD RECOGNITION: TOWARDS A PRELIMINARY MODEL AND ITS IMPLICATIONS FOR DEFINING GOOD AND POOR READERS

A significant yet poorly understood question in the literature on reading research is what is meant by the process of "decoding" or "word recognition". Of particular interest are the differences between good and poor readers with respect to these skil's.

Although much research has been conducted in an attempt to define "decoding" and "word recognition," this research has been quite fragmented. This stems partly from the fact that this research has focused usually on a few variables at a time, e.g. word frequency, word length, word meaningfulness, and word imagery, and has failed to control for the interaction between these variables. Another reason is that there has been little attempt to systematically operationalize the notion of what it means to say a word has been "decoded." Most operational definitions of decoding have emphasized identification or reproduction of physical aspects of a word, e.g. speed by which words can be pronounced, recognized, or compared under various tachistoscopic time-frame conditions. In most of these experiments, there has been little effort made to operationalize decoding as some type of process whereby one arrives at the meaning of a word. A third reason for the confusion in word-recognition

research is that researchers have been more preoccupied with discovering data to support a given model rather than creating models which account for the disparate, often contredictory data. A final problem with word-recognition studies is that they have focused primarily on the question, "How is a word recognized?" and have overlooked the question, "Why is a word recognized?" In this regard, word recognition has been preoccupied with investigating a means relative to no well identified ends. These limitations in word-recognitoin research have been carried over into the research of those who have attempted to distinguish between good and poor readers' abilIty to comprehend words.

The purpose of this paper is to suggest several ways research in word recognition might overcome these limitations. These suggestions will then be extended as a possible framework for distinguishing between good and poor readers' ability to comprehend words. The paper begins by reviewing the major models of word recognition. The limitations of these models are discussed and a new model is proposed. Evidence for this model is cited. Finally, the implications of this new model are discussed in terms of a possible explanation of how good and poor readers comprehend words differently.

Models of Word Recognition

Three models of word recognition have been proposed: the bottom-up model, the top-down model, and the interactive model. The bottom-up model assumes that word recognition proceeds through a linear series of analyzing stages beginning with the sensory representation and culminating in meaning (e.g. Gough, 1972; LaBerge & Samuels, 1974; Mattingly, 1972; Norman, 1972). In the top-down model, it is assumed that the cognitive system directs the type and amount of information abstracted from the visual signal. The cognitive system is said to "select available cues" or "confirm expectancies." Under this approach, reading is viewed as a problem-solving task, with the visual signals simply being sampled, and only partially analyzed to confirm semantic hypotheses (e.g. Smith, 1971; Kolers, 1970). While some top-down systems are assumed to sample from several sources of information, including phonological sources (e.g. Goodman, 1970), others are assumed to specifically exclude the use of information from speech analyses (e.g. Smith, 1973).

A third type of model, descriptive of how words are recognized, is the interactive model. Interactive models may assume that processing is either bottom-up or top-down, but whatever direction the processing, these models assume that processing occurs simultaneously at several levels of analysis. Under this approach, word comprehension is said to depend on

information provided from all levels of processing (e.g. Norman & Bobrow, 1976; Rumelhart, 1976). Interactive models seem to differ from top-down systems largely in terms of the independence, yet interactiveness, of the various levels of analysis. This means that in the interactive system, each informational level (e.g. feature, letter, syntactic, semantic) attempts to solve the message input at its own level. Although each level's hypotheses are constrained by information from other levels, each level does its own job and is not simply a data source for the semantic system, which directs processing and decides where comprehension has occurred. Rather, comprehension is achieved when the message is understood at all levels of analysis (e.g. Rumelhart, 1976). Thus, instead of directing processing, the cognitive system might constrain the hypotheses at "lower" levels of analysis, but is also itself constrained by lower level information (e.g. Hawkins, Reicher, Rogers, & Peterson, 1976; Marslen-Wilson & Welsh, 1978).

Unfortunately, even given these three models, there has been little consensus as to what is the basic unit of lexical processing and how this processing actually occurs relative to the different levels of a word. For example, even if one were to adopt the bottom-up model, one is still left with the problem of deciding whether the word is first recognized as a letter by letter event (e.g. Gough, 1972) as a series of spelling pattern units (e.g. Gibson, Pick, Osser, & Hammond, 1962;

Gibson, Bishop, Schiff, & Smith, 1964; Gibson, 1970), or as a whole unit (e.g. Johnson, 1975, 1977).

Furthermore, even given the constraints of a bottom-up model, one further must decide among the following alternative interpretations of the lexical processing procedure. The first interpretation is that speech recoding does not occur as a mediating stage between visual and meaning analyses; this position maintains that there are direct pathways from the visual signals to meaning, making an intermediary phonemic stage unnecessary (e. g. Baron, 1973; LaBerge, 1972; LaBerge & Samuels, 1974). The second interpretation is that recoding visual signals into a speech code is necessary in order to address those items in the mental lexicon (e.g. Gough, 1972; Rubenstein, Lewis, & Rubenstein, 1971). This view claims that the reader proceeds through the text in a letter-to-sound-to-meaning manner. The third interpretation is that the lexical access of each word occurs without speech recoding, but speech recoding then occurs in working or short-term memory in order to keep single items active long enough for semantic integration or message comprehension to occur (e.g. Johnson, 1977).

The basic problem posed by these different models and different positions is that although they suggest competing, often times contradictory hypotheses, they each can be supported empirically. In short, one can cite evidence supporting any one of the three models outlined above, supporting

any one of the positions that the letter, the multi-letter, or the word is the basic unit of word recognition, and supporting the positions that lexical recoding does take place--either directly or indirectly--or does not take place. (For substantial reviews of the evidence supporting these various positions, see LaBerge & Samuels, 1977; Levy, 1977; Marslen-Wilson & Welsh, 1978; Meyer, Schvaneveldt, & Ruddy, 1974.)

To account for this discrepant evidence, several reading researchers have argued that people process words differently because they possess different word recognition skills (e.g. Guthrie, 1973; Guthrie & Seifert, 1977; Jorm, 1977; Juel, 1978, Mason, 1976, 1977, 1978; Samuels, Begy, & Chen, 1975-1976). The basic shortcoming of this explanation is that it assumes that all children share the same purpose in processing a word--i.e. arriving at its semantic meaning. Such a view is expressed by Postman and Krusei (1977, p. 368) when they note for subjects when given a levels-of-processing task:

> . . . It may be well to remember that subjects come to the experiment with a lifelong habit of processing words semantically. It may be a basic error to assume that instructions to attend to a nonsemantic property effectively shunt out this disposition. Rather, the imposition of a nonsemantic task may interfere to a greater or lesser degree with a persisting tendency to process words semantically. Thus, we see considerable merit in the recent suggestion of

Arbuckle and Katz (1976) that nonsemantic orienting tasks may 'simply provide a less efficient means of encoding semantic information' (1976, p. 362).

The typical view, then, is that good and poor readers both maintain the same goal when recognizing words--the goal of arriving at a word's semantic meaning. It is traditionally assumed that because poor readers are less adept at achieving this goal than good readers, then poor readers must have some type of developmental deficiency, strategy deficiency, linguistic deficiency, or sensory deficiency (cf. Cromer, 1970; Oaken, Wiener, & Cromer, 1971; Steiner, Wiener, & Cromer, 1971).

An alternative explanation of why people, especially good and poor readers, perform so differently in word recognition studies is because people have different goals, e.g. expectations or intentions, for processing words. Morris, Bransford, and Franks (1977) have demonstrated this point by noting that people attend first to the meaningfulness of a task before they attend to the meaning of a stimulus. In their study, they showed that the semantic level of a word is not the most meaningful dimension of a word for a subject whose goal it is to recognize words which rhyme. Several other studies have similarly presented evidence that people's intention to process determines how a stimulus is to be interpreted, even more than the semantic meaning inherent within the stimulus itself (e.g. Brewer, 1973; Flavell & Wellman, 1977; Mosenthal, 1977; Spiro, 1977).

That a person's goal determines the manner in which a person will process a word has been forcibly demonstrated in studies by Thompson, Massaro, and Estes. In a series of experiments, Thompson and Massaro (1973) and Massaro (1973) demonstrated that subjects with a goal for processing words at a given level will make optimal use of this level, excluding or minimizing information from other levels. In particular, in their experiments, Thompson and Massaro showed that if target letters are known in advance, then letters can be identified more accurately in isolation than in the context of a word or pronounceable nonword. On the other hand, when the target letters are not known in advance, letters can be identified more accurately in the context of a word. Similar results have been obtained by Bjork and Estes (1973) and Estes (1975, 1977).

A Preliminary Model of Word Recognition

These studies suggest that a model of word recognition cannot exist in isolation idependent of other contexts. Unfortunately, most available models operate under just this assumption. That is, most models fail to consider or account for the social context of the reading act, the motivational context of the task, the schema brought to the task by the reader, and the reader's range of strategies for operating within the framework of the linguistic context of the word, phrase, setence, paragraph or story. In short, what is being

proposed here is that lexical processing is dependent upon not only upon linguistic factors, but paralinguistic factors as well (See Fig. 1).

Social context. Social context refers to the cooperative interaction between the experimenter and a subject. The experimenter typically establishes standards and forms of appropriate behavior, or at least the subject generates some notions of what demands the experimenter is imposing on production behavior. This communicative interaction between experimenter and subject in the context of testing situations can vary widely with resulting differential effects on subject's performance on experimental tasks (Brewer, 1974; Morris, Bransford, & Franks, 1976; Mosenthal, 1977; Spiro, 1977).

Motivational context. Motivational context is derived from social context and is represented by the intention the subject develops for participating in the task. Intentions may be charactered in the following terms: (a) reproduction, in which the reader's intention is to accurately and faithfully produce a response which matches a stimulus (for example, "oral recoding") (b) reconstruction, in which the reader's intention is to generate an inference with only a modicum of intention of producing a response to match the stimulus (for example, inferring the meaning of a word from an inspection of a limited sample of orthographic features); (c) embellishment, in which the reader generates an inference with a cavalier disregard

for the match between response and stimulus (for example, making up a letter or word that represents a guess, independent of a given decoding context). Depending upon how formal or structured a subject perceives a testing situation to be, a subject will select his intention type to process a word accordingly (cf. Mosenthal, 1977; Spiro, 1977).

Schema. Schema refers to the manner in which a person shapes new experiences in light of his previous knowledge of the world. The work of Mosenthal (1977) and Spiro (1977) suggests that the more formal or structured a testing situation is, the less likely a subject will restructure a given experience or stimulus in light of personal world knowledge. In formal testing situations, subjects do not process new information for the purpose of up-dating knowledge; rather they process information relative to the ends which they perceive an experimenter is testing for. In terms of word recognition, this would suggest that subjects will process the word at the level which they believe the experimenter is investigating.

Range of Strategies. This paper argues that in order for a word to be recognized, a variety of strategies may be used to relate paralinguistic and linguistic contexts in such a way that a subject's response is in agreement with his perceived meaningfulness of a given social situation (cf. Morris, Bransford, & Franks, 1977). In short, a

subject may use a variety of strategies to reproduce, reconstruct, or embellish information within, between, and/or among the levels of a word, as the subject deems appropriate relative to his perception of the task in general.

Linguistic Context. This paper maintains that linguistic context can be conceptualized in terms of five phenomena: Event, level, context, inference, and frame. Event refers to the physical dimension of the linguistic stimulus. Events can be perceived as being comprised of linguistic units of varying sizes, e.g. an orthographic feature (for example, the b in b), a whole letter comprised of several orthographic features, a syllable which may be comprised of several letters, etc. These various combinations of units constitute the various linguistic levels within a word. A word itself may appear as a unit in such larger levels as the phrase, sentence, paragraph or story. Inference refers to the assumptive guess a subject makes regarding the veridical nature of an event at a given lexical level. A frame is an expectancy which organizes new linguistic events in terms of known linguistic events. For example, speakers of English would have frames for such letter, word-initial combinations as sp or bl but not xp or zt. In sum, frames provide a unifying context into which different level linguistic events may be fit and understood.

Given these definitions and given that level and direction of processing is a function of the goal which a person brings to the word-recognition task, the variable nature of word comprehension can be accounted for by the following model (see Fig. 2). The model posits that word recognition is basically an inference generating, inference confirming process which may lead to either reproductive, reconstructive, or embellished understanding of a word or words in context. Depending upon the level of understanding a person wishes to achieve and the person's disposition for processing at a given level (this may be a personal decision or may be task invoked), a person inputs the word as a new event. Depending upon the level at which one is processing, a set of plausible inferences from this event are generated as a means for recognizing a given level of the word. The actual number of inferences generated, of course, depends upon the interrelationship between paralinguistic and linguistic variables previously identified. If there is a currently active frame or context which identifies the particulars of this word level, it is stored with its inferences. If this level matches the person's intended level of processing and if a person is willing to accept the certainty of his inference as to the meaningfulness of a given level, the person will discontinue further processing of the word.

It may, however, be the case that a person cannot find an active frame by which the particulars of a given word level

can be identified. Or it may be the case that although a person begins to process the word at one level, he had the additional intention of interpreting the word at another level. Or it may be the case where a person is uncertain with regard to the amount of lexical information he used to identify a word. Depending upon which one of these reasons (or combination of reasons) occurs, the reader will proceed to another level of the word, will generate a new plausible inference about the nature of this level. Again, if there is a currently active frame or context which identifies the particulars of this word level, this frame or context is stored with its inferences. If for the reasons cited above, a person may wish to move to another level to generate and confirm additional inferences, newly generated and confirmed inferences and frames may or may not make use of the previously stored knowledge generated and confirmed at one or more of the levels previously processed.

An additional assumption of this model is that if a person is unable to generate a plausible inference or if he is uncertain as to the validity ofhis generated frame and inference, he may prefer not to adopt the strategy of proceeding to an additional level. On the other hand, he may simply generate new frames and inferences <u>within</u> the level he is presently processing, in order to account for the incoming event.

Defining Good and Poor Readers in Light of the Preceding Model

Given the previously explicated model of word recognition, one can begin to note the possible bases for reading disability. The proposed model presents several alternatives accounting for differences in performances of able and disabled readers.

Poor readers may, for instance, be less sensitive to social context which in turn will influence one's perception of their reading ability. One instance of this might be found in readers who, although they can speak in a standard as well as in a minority dialect, produce text in a dialect other than Standard English. If the experimenter accepts only the production of text in Standard English as evident of good reading, then readers producing dialect responses would be viewed as disabled. The reader who is sensitive to the experimenter's expectations and produces responses in Standard English, rather than in some other dialect, then is viewed as a good reader. Another reader who is insensitive to these expectations and produces responses in another dialect will be viewed as a poor reader, even though these readers might not differ in their understanding of the material.

Readers may also differ in the motivational context. Depending upon the social context, either reproduction, reconstruction, or embellishment may be the most appropriate intention. For example, embellishment might be appropriate in skimming, or speed reading, while reconstruction is appropriate

when getting information from a textbook. Reproduction has been the intention most often elicited in experimental situations both in word recognition and in prose learning research. Good and poor readers seem to differ in their ability to select the most appropriate intention and in the ability to generate different intentions for the reading act.

Good and poor readers may differ in their ability of knowing how to relate schema to text. Good readers seem to be sensitive to the fact that while in formal testing and instruction situations, they attempt to bring only a minimal amount of world knowledge to the reading task; they read for the tester's or teacher's meaning. Poor readers may well differ from good readers since they lack this sensitivity.

Another factor which may distinguish between good and poor readers is that good readers have a broad range of strategies for relating word level processing with socially defined paralinguistic considerations. While poor readers may be sensitive to certain paralinguistic ends, they may find it difficult to employ strategies facilitating these ends.

In sum, it may not be just the fact that poor readers may be lacking in linguistic skills; it may well be that poor readers aren't capable of recruiting linguistic skills relative to larger end as defined by the social context.

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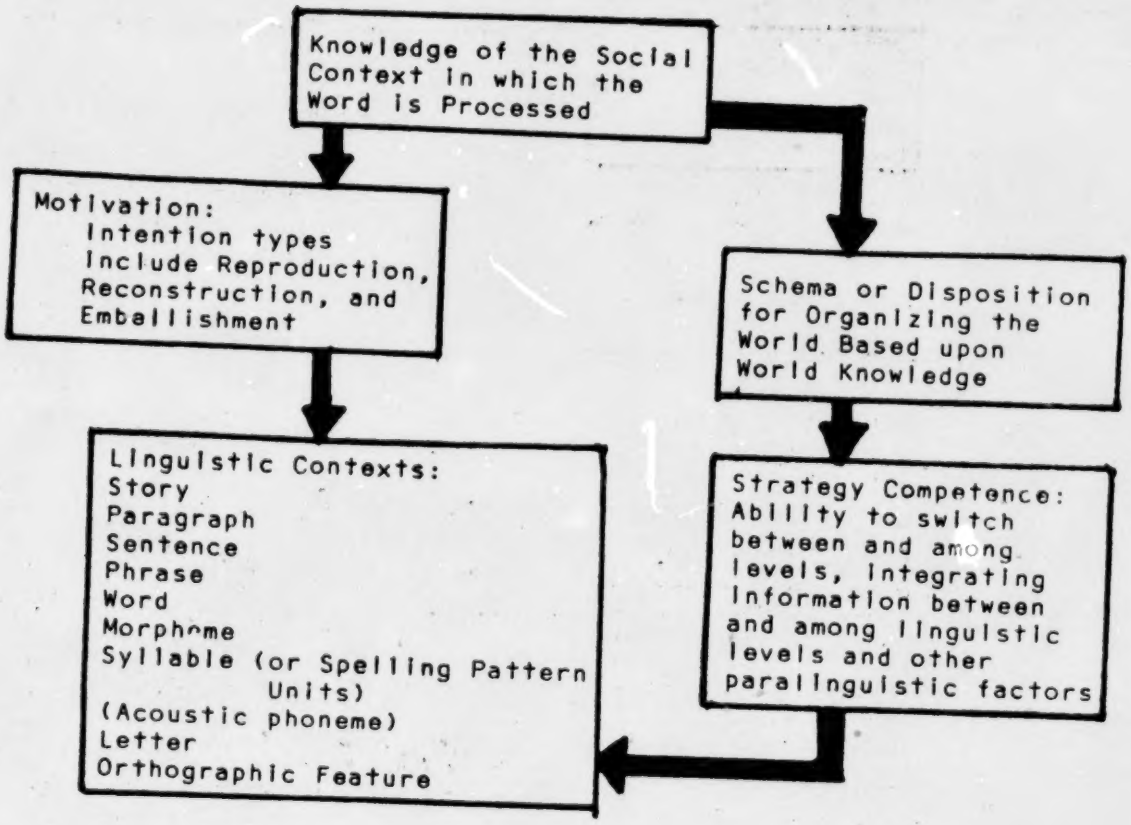
Knowledge of the Social Context in which the Word is Processed
Motivation:
Intention types include Reproduction, Reconstruction, and Embellishment
Schema or Disposition for Organizing the World Based upon World Knowledge
Linguistic Contexts:
Story
Paragraph
Sentence
Phrase
Word
Morpheme
Syllable (or Spelling Pattern Units)
(Acoustic phoneme)
Letter
Orthographic Feature
Strategy Competence: Ability to switch between and among levels, integrating information between and among linguistic levels and other paralinguistic factors

Figure 1. Linguistic and paralinguistic factors influencing the manner in which a person recognizes a word.

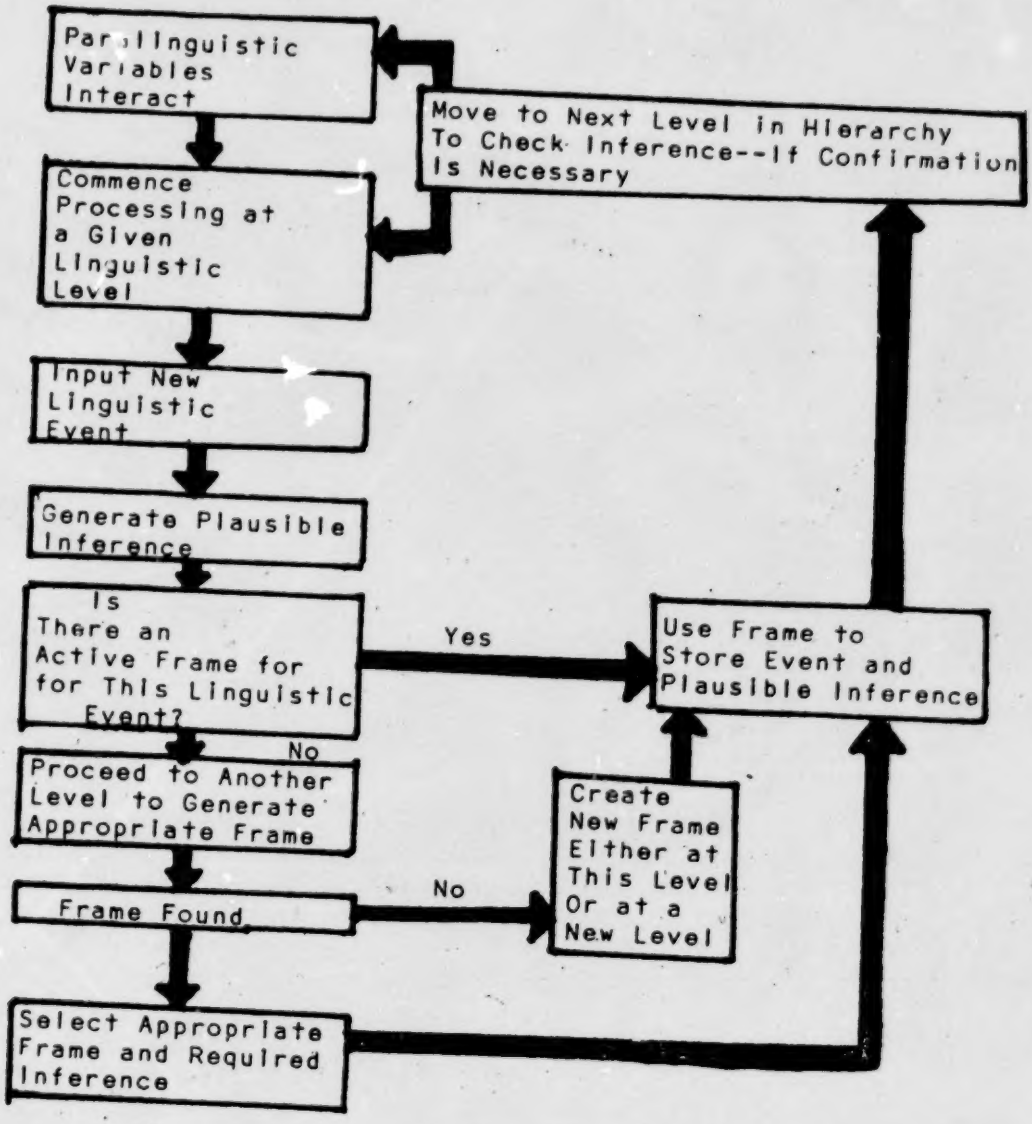
Paralinguistic Variables Interact
Commence Processing at a Given Linguistic Level
Input New Linguistic Event
Generate Plausible Inference
Is There an Active Frame for for This Linguistic Event?
Yes
No
Proceed to Another Level to Generate Appropriate Frame
Frame Found
No
Select Appropriate Frame and Required Inference
Create New Frame Either at This Level Or at a New Level
Use Frame to Store Event and Plausible Inference
Move to Next Level in Hierarchy To Check Inference--If Confirmation Is Necessary

Figure 2. Word recognition procedures within the domain of the linguistic context.